



The Pocketbook for Physiotherapists

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4th
Edition



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CHAPTER

Electrotherapy

- **Therapeutic Electric Current**
- **Electrophysical Agents**
- **Principles of Electrotherapy Application**
- **Treatment Protocols**
- **TENS (Transcutaneous Electrical Nerve Stimulator)**
- **Electrical Muscle Stimulation (EMS)**
- **Iontophoresis**
- **Strength Duration Curve**
- **IFT (Interferential Therapy)**
- **Diathermy**
- **UST (Ultrasound Therapy)**
- **Phonophoresis**
- **LASER (Light Amplification by Stimulated Emission of Radiation)**
- **IRR (Infrared Radiation)**
- **UVR (Ultraviolet Radiation)**
- **Paraffin Wax Bath (PWB)**
- **Cryotherapy**
- **Mechanical Traction**

THERAPEUTIC ELECTRIC CURRENT

Type of current	Low frequency currents	Medium frequency currents	High frequency currents
Examples	TENS, EMS, Diadynamic	IFT, Russian, Rebox	SWD, LWD, MWD, UST, LASER, etc.
Frequency range	0 to 1,000 Hz	1,000 to 10,000 Hz	10,000 and above
SWD, shortwave diathermy; LWD, long-wave diathermy; MWD, microwave diathermy			

ELECTROPHYSICAL AGENTS

Electrophysical agents are the different ways of applying energy and materials to the patients for the betterment of their conditions and relieving the ailments. They may include—heat, cold, water, pressure, sound, electromagnetic radiation, and electrical currents. For the convenience of understanding they are being categorized into following categories:

- ❖ **Thermal agents:** Thermal agents are the physical agents in which, as shown by the name, we are expected to give any form of thermal energy to the patient—may be heat or cold.
- ❖ **Mechanical agents:** These are the agents in which mechanical force is given to the patient. They can be either traction force or compression forces provided via different means.

- ❖ **Electromagnetic agents:** Electro-magnetic agents are the agents which include two different types of physical agents to be delivered to the patient's skin, in this category electromagnetic field radiation and electric currents are applied.

S.No.	Physical agent		Example
1.	Thermal agents	Heating agents	Deep heating—SWD, LWD, MWD Superficial agents- Hot pack, etc.
		Cooling agents	Ice Pack, Ice massage, Ice towel, & all types of cryotherapy agents.
2.	Mechanical agents	Traction	Mechanical traction, manual traction, positional traction, etc.
		Compression	Compression bandaging, intermittent pneumatic compression devices, etc.
		Water	Whirlpool bath, Hydrotherapy, etc.
		Sound	UST (Ultrasound therapy)
3.	Electro-magnetic agents	Electromagnetic field radiation	UVR (Ultraviolet radiation), IRR (infrared radiation), LASER, etc.
		Electric currents	TENS, IFT, Muscle stimulation, Russian, Rebox, Diadynamic, etc.

PRINCIPLES OF ELECTROTHERAPY APPLICATION

PURPOSE

- ❖ To promote healing
- ❖ To reduce pain
- ❖ To increase soft tissue extensibility
- ❖ To correct the altered muscle tone
- ❖ To improve ROM.

GENERAL CONTRAINDICATIONS

- ❖ Pregnancy
- ❖ Malignancy
- ❖ Pacemaker or other implanted electronic device
- ❖ Impaired sensation
- ❖ Impaired mentation.

PRECAUTIONS

- ❖ Avoid exposure to pregnant uterus via diathermy radiations.
- ❖ Avoid application of any electrotherapy apparatus over an implanted electrical device.
- ❖ Avoid application of diathermy modalities over the tissues with metallic implants.
- ❖ Avoid exposure with diathermy to a patient with pacemaker in situ.
- ❖ Apply appropriate pressure over electrode with electrical current of any frequency.

- ❖ Apply even jelly over electrodes' active surface for proper stimulation and avoiding accumulation of current.
- ❖ Proper application of each modality with correct method of placement of electrodes.
- ❖ Appropriate spacing between electrodes to have correct exposure and avoiding undue exposure by modality.
- ❖ Appropriate selection of specific gel for application, such as USG gel is the best to use for UST rather ECG gel having more ions will be preferable for use in delivering electric current.
- ❖ Regular observations of the area to be treated while any physical agent is being applied to the patient with impaired sensation or mentation.

■ SAFETY ISSUES WHILE USING ELECTROTHERAPY

Thermotherapy

Superficial Heating

- ❖ Avoid direct contact with skin or shorter distance with the use of IRR.
- ❖ Sufficient layering and thickness of towel while using moist heat therapy to prevent burn/scalds.
- ❖ Avoid heating over devitalized tissue and areas with metal implants to prevent burn/gangrene.
- ❖ Treatment duration should be always less than 30 minutes.
- ❖ Proper regulation of intensity, distance and duration of treatment especially in case where sensory loss is present.

- ❖ Preparation of skin must be done before the application of apparatus.
- ❖ Application of any physical agent over eyes and genitals is contraindicated.
- ❖ Avoid exposure over cancerous, thrombosed, PVD, DVT, phlebitis tissue.
- ❖ Use goggles for safety of eyes while applying UVR and LASER.
- ❖ Proper disinfection and preparation of treatment tray.

Deep Heating

- ❖ Electromagnetic energy/electromagnetic field is strongest near to electrodes while magnetic field is strongest around the cable.
- ❖ It should not be applied over the areas of metallic implants, because it may cause burn.
- ❖ According to the guidelines given by IRPA (International Radiation Protection Association) or NRPB (National Radiological Protection Board) like—Physiotherapists and Physiotherapy assistants should be 1 meter away from apparatus and cable of diathermy to avoid unnecessary exposure.
- ❖ Physiotherapist and patients eyes must not get any unwanted exposure although cable and electrodes should be away from these.
- ❖ SWD must be kept 1 meter apart from other apparatus, personnel to avoid interference rather electrical

stimulation must be kept 2 meters apart from PSWD and 2 diathermy modalities should be positioned at least 3 meters apart from each other.

Sonotherapy

- ❖ Burn can be caused by development of standing waves while using UST.
- ❖ Standing wave may also cause thrombus formation and tissue damage.

Actinotherapy

- ❖ UVR emitted from various sources can be hazardous and carcinogenic for biological tissues in many circumstances if individual comes in vicinity to radiation scattered and reflected.
- ❖ Use of low-dose UVR is recommended to avoid its adverse effects.

Electric Current Stimulation

Direct Current

- ❖ Continuous application of direct current produces more hazardous effects, such as local infection, electrical burn, chemical burn, tissue reaction from electrodes.
- ❖ Undesirable metabolic activity in the tissue with healed tuberculous infection along with skin damage and irritation especially at the area of sensory loss. Electrodes must be in good contact with skin.

- ❖ Proper spacing between electrodes must be maintained to avoid short circuit.
- ❖ Cleaning of treated area of skin to remove any alkaline solution produced.
- ❖ Self and pretreatment testing of apparatus is mandatory to avoid any danger.

Alternating Current

While using faradic current we can achieve mechanical effects without any chemical reaction with the use of frequency modulation.

TREATMENT PROTOCOLS

RECEIVING THE PATIENT

- ❖ Good morning sir/madam.
- ❖ Please be seated (Please take your seat).
- ❖ I am your physiotherapist, who is going to treat you.
- ❖ Do not worry; I will do my best for you.
- ❖ Legal consent form filled by the patient or his/her relative before going for treatment.

CASE SHEET READING

- ❖ Laboratory investigation reports.
- ❖ Assessment and diagnosis done by the physician.
- ❖ Special instruction for physiotherapist.

Trolley Preparation

Skin Sensation Testing Tray

- ❖ Pillow
- ❖ Cotton
- ❖ Soap
- ❖ Towel
- ❖ Macintosh
- ❖ Kidney tray
- ❖ Petroleum jelly or vaseline
- ❖ Test tubes (hot and cold)
- ❖ U-pin (sharp and blunt)
- ❖ Clips
- ❖ Bowl of water
- ❖ IR lamp
- ❖ Hot and cold packs.

Treatment Tray

- ❖ Pillow
- ❖ Towel
- ❖ Bedsheet
- ❖ Cotton
- ❖ Adhesive tapes
- ❖ Straps
- ❖ Salt
- ❖ Powder
- ❖ Scissors
- ❖ Inch tape

- ❖ Paper
- ❖ Graph paper
- ❖ Pencil
- ❖ Eraser
- ❖ Scale
- ❖ Goggles
- ❖ Machine and accessories
- ❖ Sandbags
- ❖ Crepe bandages.

APPARATUS PREPARATION

- ❖ The apparatus and accessories needed should be assembled and suitably positioned.
- ❖ Visually check the electrodes, leads, cables, plugs, power outlets, switches, controls, dials, and indicator lights for cracks and breaks.

PATIENT EDUCATION

- ❖ Check the apparatus in front of the patient.
- ❖ Demonstrate and explain the treatment procedure to the patient.
- ❖ Explain about the type of sensation which will be experienced by the patient.

POSITIONING THE PATIENT

- ❖ The position of the part to be treated should be completely relaxed.

- ❖ Patient should be made comfortable by using maximum number of pillows and sandbags for the support.
- ❖ Position of the patient should be such that all the joints of the body are completely relaxed.
- ❖ If possible, give the position in which patient can see the treatment.
- ❖ Uncover the part to be treated.
- ❖ Use pillows, macintosh and towel for supporting and whipping off the water.
- ❖ Make use of soap and possible hot water as it will make the skin surface warm.

■ PLACEMENT OF ELECTRODES

- ❖ Place electrodes properly (**Figs. 2.1A and B**)
- ❖ Use adhesive tapes or straps for placing the electrodes.
- ❖ Apply electrode gel evenly on entire electrode.
- ❖ Maintain good contact between the skin and the electrode.
- ❖ Tie the electrodes with even pressure.
- ❖ Wires or leads should not cross each other during the treatment.
- ❖ Again check all the connections.

■ INSTRUCTIONS TO THE PATIENTS

- ❖ Do not move during the treatment.
- ❖ Do not sleep while the treatment is going on.

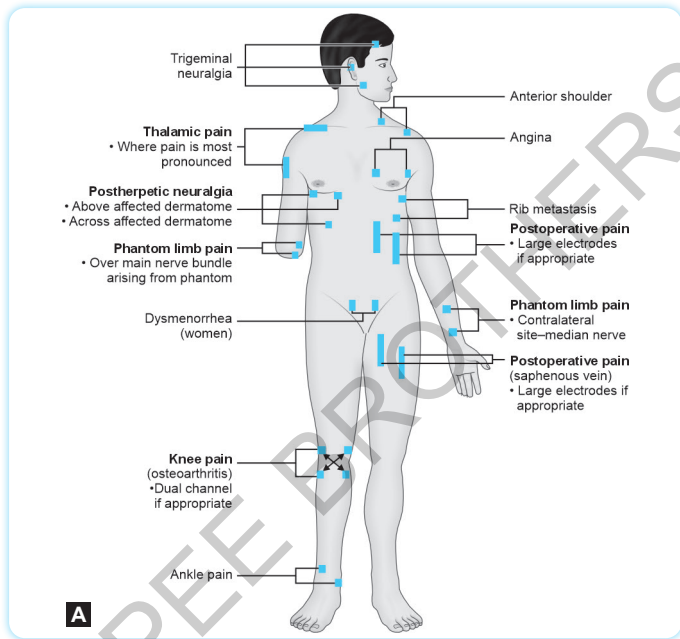
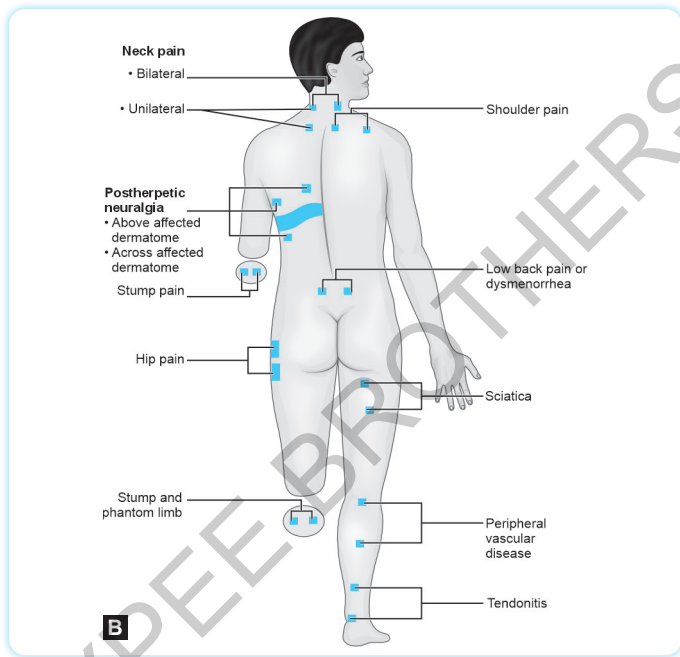


Fig. 2.1A



Figs. 2.1A and B: Electrode placement: (A) Anterior aspects; (B) Posterior aspects.

The Pocketbook for Physiotherapists

Salient Features

- Written in simple and lucid language
- Well-drawn illustrations and line graphics
- Deals with all the important stuff related to various branches of physiotherapy
- Maximally expanded and added with latest information
- Biochemical and hematological values and expanded pharmacology
- Useful for undergraduates, postgraduates, physiotherapists, and rehabilitation specialists

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